

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

Wireless E911 Location Accuracy Requirements

PS Docket No. 07-114

COMMENTS OF QUALCOMM INCORPORATED

Qualcomm is pleased to comment on the Commission’s Fourth Further Notice of Proposed Rulemaking aimed at improving the location accuracy of wireless E911 callers located inside of buildings.¹ Qualcomm is a leading wireless research and technology developer that tirelessly works to integrate new and improved communications interfaces and capabilities, including the best available position location technologies, into mobile devices as soon as possible to continually improve the means by which users communicate, compute, access content, and interact. Qualcomm has a long history of developing leading edge technologies that support E911 caller location and, through working alongside our wireless industry partners, remains committed to attaining the goals set out in the FNPRM to help first responders locate E911 callers more efficiently, wherever they may be experiencing an emergency.

INTRODUCTION & SUMMARY

There is no question that mobile phones serve an indispensable role in our everyday lives and that the usefulness of anywhere / anytime mobile connectivity is becoming increasingly important. In addition to providing direct access to family, friends, and co-workers, and up-to-

¹ See *Wireless E911 Location Accuracy Requirements*, Fourth Further Notice of Proposed Rulemaking, FCC 19-20, PS Docket No. 07-114 (rel. Mar. 18, 2019) (“FNPRM”).

the-minute news, weather, maps, and countless other highly useful applications, mobile connectivity improves users' lives by protecting their health, property, and well-being. It is not surprising that many Americans now rely exclusively on mobile phones and use landline phones less often or not at all. Thus, providing the most reliable means of locating wireless E911 callers during emergency situations is increasingly important.²

Qualcomm agrees it is of the utmost importance that indoor location technologies be deployed reliably and ubiquitously, so 911 callers can be reliably located anywhere they are experiencing an emergency. At the same time, it is imperative that the FCC offer the wireless industry the utmost flexibility to achieving this goal and providing PSAPs the information they need to deploy public safety assistance to indoor E911 callers as soon as possible.

The Commission should encourage the ongoing efforts of the wireless industry, the public safety community, and other stakeholders to work together through CSRIC, ATIS, and 3GPP and other collaborative bodies with the objective of developing a detailed, implementable plan by which indoor location technologies can be further developed, rigorously tested, and refined over time. Prematurely imposing compliance deadlines for technologies that need further development and testing may be counterproductive to the ultimate goal of continually improving indoor location accuracy of wireless E911 callers.

Before the Commission adopts specific z-axis criteria for E911 indoor location purposes, the agency should allow all potentially viable indoor positioning technologies to be assessed for their performance — including their ability to be ubiquitously deployed successfully, timely, and cost-effectively by wireless carriers and public safety agencies.

² See FNPRM at ¶ 1.

DISCUSSION

I. Qualcomm Strongly Supports Improving The Location Determination Accuracy Of Indoor E911 Callers

Qualcomm has a long history of providing life-saving technologies that support wireless E911 caller location, and we have been serving public safety needs since our inception more than three decades ago. We have been committed to the highest degree of E911 location accuracy since before the Commission first promulgated wireless location accuracy regulations in 1998.

Qualcomm pioneered the development of today's broadly implemented and highly successful Assisted - Global Navigation Satellite System ("A-GNSS") wireless cellular position location technology, which provides highly accurate results for E911 callers located outdoors in accordance with the Commission's E911 mandates by combining the strengths of satellite-based navigation technology and cell site triangulation techniques. A-GNSS has been successfully implemented worldwide by many dozens of wireless carriers and OEMs, and it is being used to locate many millions of E911 callers.

Qualcomm continues to work tirelessly developing location technologies that improve wireless services and save lives. Today, we are working on enhancing location accuracy through hybrid systems that take advantage of the latest mobile handset and network capabilities.

A. Successful Deployment Of Indoor Location Determination Technologies Requires Further Development Work, Systems Integration, And Testing To Validate That The Z-Axis Metric Proposed By the FCC Can Be Met

Implementing new indoor positioning technologies requires additional development work, more extensive testing in diverse environments and building types, and collaborative hardware and software integration with regard to devices and infrastructure, before the substantial work can be undertaken to fully integrate at scale one or more of these technologies

into carrier networks, devices across all tiers, and PSAP systems across the country for ubiquitous deployment, all of which is essential for successful E911 service.

The wireless industry has been actively working to implement indoor location technologies and improving existing technologies to more accurately locate wireless 911 callers. The focus of this work includes using new cellular air interfaces not previously used for E911, including 5G interfaces, additional satellite constellations, and other wireless infrastructure, such as Wi-Fi access points, Bluetooth beacons and small cells, as well as information provided by sensors within today's smartphones, all to deliver more accurate positioning information.

The commercial wireless industry has tested and validated a number of horizontal X-Y location solutions in the 911 Location Accuracy Technologies Test Bed, including A-GNSS, Observed Time of Arrival ("OTDOA"), Wi-Fi and Device-Based Hybrid ("DBH") technologies. Today, wireless providers are harnessing commercial technologies to support these solutions that have been shown to comply with the Commission's updated horizontal location requirements.

In contrast, vertical location solutions that can meet the proposed rule are not commercially available today. The Z-Axis Test Bed Report that CTIA submitted in this docket was not able to validate any vertical location technology at +/- 3 meter accuracy across all test regions and morphologies.³ Qualcomm believes that successful deployment of indoor location determination technologies requires further development work, systems integration, and testing across all regions and required morphologies.

³ See CTIA Ex Parte Letter *and attached* 9-1-1 Location Technologies Test Bed, LLC, Stage Z Report (Aug. 3, 2018).

B. Dispatchable Location Test Results Demonstrate A Viable Solution That Includes A Floor Level Determination, But Increasing The NEAD Database Population Will Be Essential To Its Success

The NEAD test report prepared by ATIS last month demonstrates that the NEAD is a valid option for locating callers inside of buildings, but the database of Wi-Fi Access Points (“APs”) and Bluetooth Beacons will need additional accurate data in order for this solution to be viable in all regions and morphologies.⁴ While the NEAD test report notes several key limitations that would need to be addressed prior to widescale deployment, including improved implementation via augmentation with additional database entries, the report establishes the validity of the NEAD concept.

Qualcomm believes that the NEAD, with augmentation of the database and broader handset support, could provide public safety personnel with reliable and actionable indoor location information from E911 callers. The NEAD database concept demonstrates the benefits of combining multiple data points – from multiple Wi-Fi APs and other fixed transceivers – into the location determination calculus. Rather than relying on the transmission of z-axis in-building height data based on a single sensor reading, the NEAD approach could provide building address as well as suite or apartment information.

C. Providing Actionable Z-Axis Information Using Barometric Pressure Sensors Requires Further Development And Testing

As the FCC acknowledges in the FNPRM, using barometric pressure sensors to provide z-axis information is far from ideal, as the current technology solution that provides +/- 3-meter accuracy is “not always certain to yield floor level accuracy.”⁵ The allowable margin of error

⁴ See ATIS Test Bed Program Management, “E911 Location Test Bed Dispatchable Location Summary Report,” (April 2019) *attached to* CTIA *Ex Parte* Letter (Apr. 26, 2019).

⁵ FNPRM at ¶ 12. *See also id.* at ¶ 19 (neither vendor could achieve +/- 2 meter accuracy in the dense urban morphology).

could place an emergency caller on any one of three floors and in any one of at least several suites or apartments that may be on each of those floors. In addition, while many smartphones today are equipped with barometric pressure sensors, not all phones sold today include such sensors. Were the Commission to adopt a z-axis metric based upon the performance of barometric pressure sensors, the agency should apply that metric to only those handsets so equipped. Also, in order for barometric pressure sensors to provide +/- 3 meter accuracy, sensor calibration needs to be addressed, preferably using a standard solution which is transparent, testable, and capable of deployment across all mobile handset OEMs.

Barometric pressure sensor location reporting as above ground level (“AGL”), even if it could be provided, may nonetheless be ambiguous and error prone; for example, what is “ground level” when the ground around a building or building complex has different heights as is quite common in a number of major U.S. cities. Other issues requiring clarity include how would ground level, for conversion from mean sea level readings to AGL, be obtained, and who should be responsible for the accuracy of the provided metric when there are multiple factors that could impact the determination.

In addition, the FNPRM acknowledges the need for substantial network buildout by vendors who participated in the evaluation process for z-axis technologies, as one vendor’s solution was not able to be tested in Chicago because its network was not yet deployed there.⁶ Aside from cold weather, there are other uncertainties and a potential for increased errors due to various air pressure phenomena, such as the stack effect and associated positive and negative in-

⁶ See FNPRM at ¶ 22 (noting that NextNav had not deployed its solution in Chicago and thus the solution was not tested in the extreme cold weather environment).

building pressurization. Ongoing testing, systems evaluation, and further refinement will be essential to a successful deployment of this technology.

Qualcomm strongly favors implementation of a standardized solution if barometric pressure sensors are adopted as the solution for providing more accurate indoor location information for E911 callers. Standardization will bring crucial benefits, but it will take some time to complete. Accordingly, the deadlines in the FNPRM should not be tightened and in all likelihood will need to be adjusted outward. Given the limitations of barometric pressure sensors to provide more precise location accuracy, the FCC should take steps to encourage the industry to further study other solutions that can provide continually improved indoor location accuracy over time.

II. The FCC Should Continue Encouraging An All-Of-The-Above Approach To Improving Indoor Location Accuracy Of E911 Callers To Achieve A Successful Long-Term Solution

The record in this proceeding demonstrates that no solution has been fully validated, so multiple simultaneous avenues to providing improved location accuracy of indoor E911 callers should continue to be pursued. The Commission should continue to encourage development, testing, and potential deployment of multiple indoor location solutions given that “no single technological approach will solve the challenge[s]” of providing accurate and actionable indoor location information.⁷ Technology solutions other than barometric pressure sensors should be pursued. Qualcomm agrees with CTIA’s affirmation that future z-axis testing needs to involve technologies other than barometric pressure sensors.⁸

⁷ FNPRM at ¶ 27.

⁸ See FNPRM at ¶ 8, n.25

As the FCC well knows, implementation of new and improved positioning technologies, particularly those that perform well indoors, requires extensive R&D, testing in diverse locales and building types, as well as collaborative hardware and software integration with regard to devices and infrastructure, before the substantial work can be undertaken to fully integrate the technologies into carrier networks, devices across all tiers, and PSAP systems across the country for ubiquitous deployment, which is essential for E911. Given that we are still at the early stages of technology development of indoor location determination solutions, the Commission should encourage continued work into multiple potential long-term technology solutions.⁹

For example, Google’s Emergency Location Service (“ELS”) is working on providing altitude and floor level information for wireless E911 calls.¹⁰ Fully integrated with the Android operating system, ELS sends enhanced location information directly from Android handsets to emergency service personnel when an emergency call is placed. ELS combines multiple location information sources and works on virtually all Android devices running version 4.0 and above without requiring any additional hardware.

Significant additional work is needed to implement a viable solution within the timeframes set out in the Commission’s rules. The ultimate solution that provides E911 caller location should be standardized so that it can be economically implemented by a multitude of technology implementers.

Before adopting specific z-axis criteria for E911 indoor location purposes, the FCC should allow all potentially viable indoor positioning technologies to be assessed for their performance — including their ability to be ubiquitously deployed successfully, timely, and cost-

⁹ See FNPRM at ¶ 27.

¹⁰ See FNPRM at ¶ 18.


effectively by wireless carriers. This work should be completed before the agency adopts final rules for E911 indoor location accuracy. Such an approach will allow the Commission to make a more informed decision in this proceeding. While new technology that supports providing z-axis data may become available within a few years, it will take additional time for the technology to achieve a high level of penetration. Thus, a location technology that can be supported by today's hardware and can be improved via other means (such as by increasing data entries in the NEAD, for example) may provide ever improving location accuracy, which is a key long-term goal of this proceeding.

CONCLUSION

Qualcomm encourages the Commission to promote continued investigation of technologies that can provide accurate indoor location information of E911 callers with a path towards greater accuracy over time, for reliably locating wireless callers who dial 911 during emergency situations is of utmost importance to the wireless industry. Qualcomm looks forward to continuing its work with the wireless industry and the public safety community to develop and deploy technologies that work well and provide a long-term path to continuously improving in-building location accuracy determinations.

Respectfully submitted,

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